

# Navy NDT&E Needs

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# Outline

- Navy swim lanes
- Challenges
- Composites
- Metals
- Coatings
- Technology Interests
- Summary





# DON is the largest branch of the DOD

**This is us**

Navy subs and surface ships



Naval Information Dominance,  
including satellite support

**SPAWAR**



Naval Air Force



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# Naval NDT&E Challenges

## ❑ Environmental & biological interaction

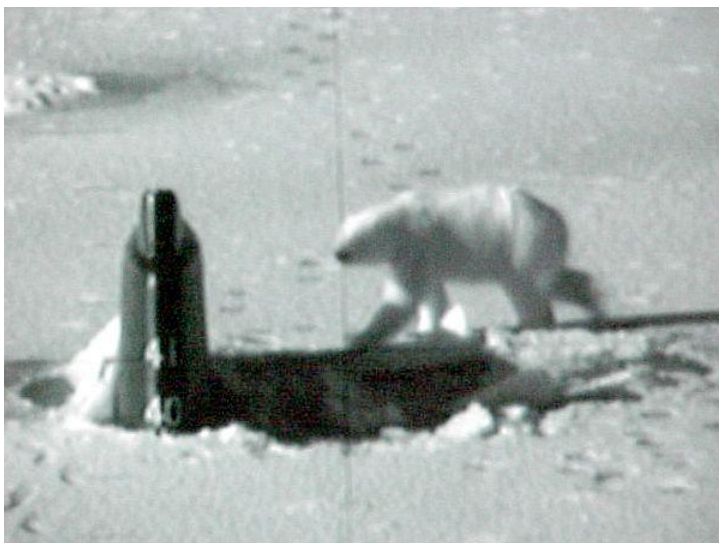
- Salt water, biological organism deterrence and safety

## ❑ Thick materials difficult to penetrate for NDT&E

- Thick metals & coatings, layered structures, hulls, impeller parts

## ❑ Large structures and limited maintenance time

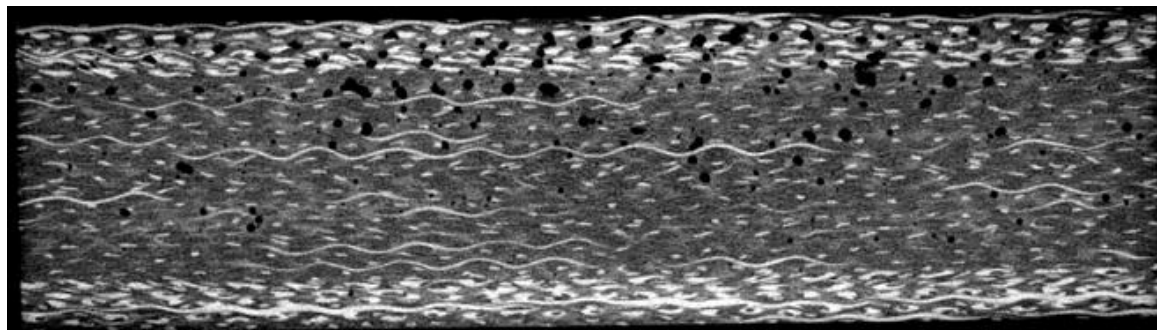
- Time in dock is time not in service (speed with accuracy)
- Dry dock & at-sea inspection



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# Composites

- ❑ **Detect and localize cracks, voids, water intrusion & debonds**
  - Multi-layered composite systems
    - » *Composites materials include fiberglass, quartz, & carbon fiber*
  - GRE composite covered in a carbon fiber layer
    - » *Carbon fiber layer can range from 1 mm to almost an inch*
    - » *Carbon fiber layer can be on one or both surfaces of composite*
  - Composite can range from fractions of an inch to several inches thick
- ❑ **Characterize fiber waviness in thick composites**



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# Metals

## ❑ Detect fatigue cracks in metals near sensitive sensors

- No magnets, excessive vibration, etc



## ❑ Detect and quantify defects in Friction Stir Welds

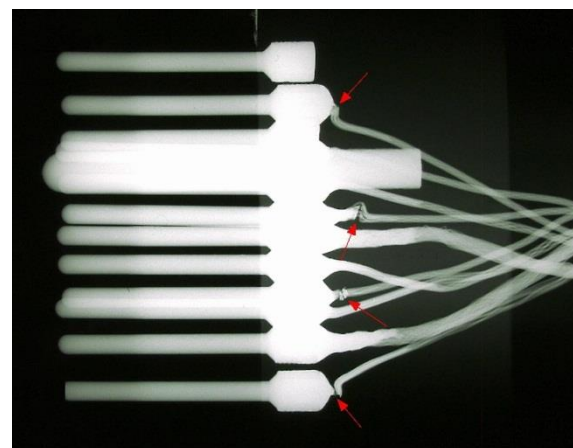
- Wormholes, excessive flash, kissing bonds

## ❑ Determine degree of sensitization and detect intergranular corrosion in AL-5000 series and austenitic steels

- In general, after repair, and under a composite coating

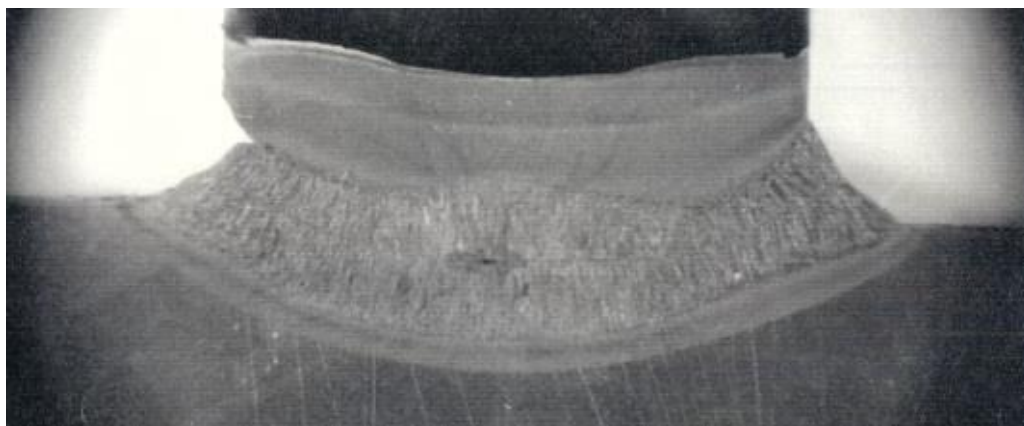
## ❑ Detect and localize broken conductors inside wires and connectors

- In air and potting/coatings



# Metals Continued

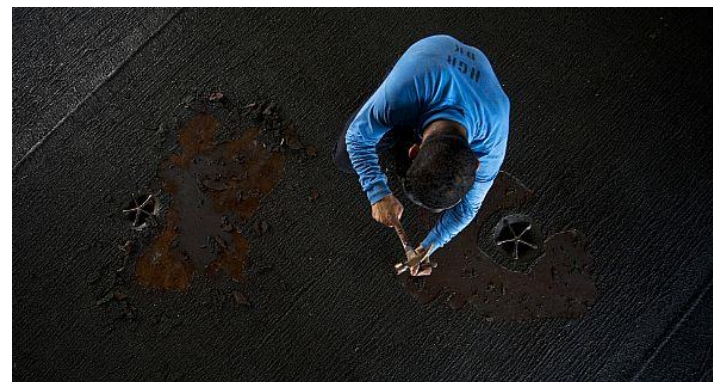
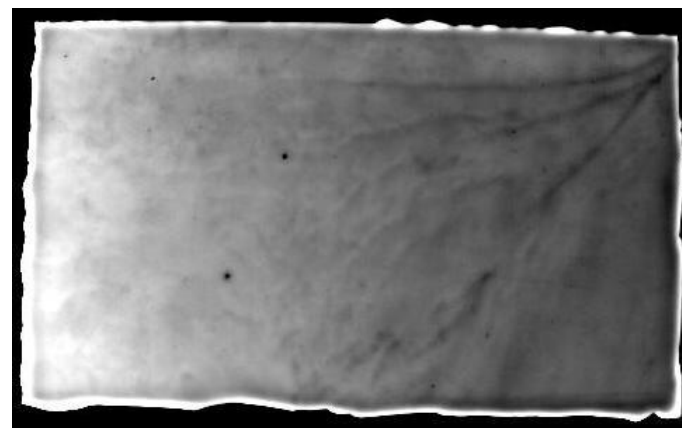
- ❑ Characterize the degree of cold working around metallic fastener holes
- ❑ Detect corroded welds at the base of studs where only the tip of the stud is accessible
- ❑ Detect metal degradation/embrittlement





# Coatings

- ❑ Find defects in and through polymer or composite coatings on metal where the metal side is inaccessible
  - Metal corrosion, damage & weld cracks in aluminum or thick steel
  - Coating debonds, voids, water intrusion & nonhomogeneities
  - Polymers could be rubbers or urethanes, thick (several inches) or thin (~1/8 inch)
- ❑ Detect water / leaks through installed pipe lagging





# Technology Interests

- ❑ **Portable, real-time, and reliable wide area impact damage inspection in composites**
  - Ruggedized for at-sea solutions or dock-side environment
- ❑ **Structural Health Monitoring (SHM)**
  - Detect and localize cracks, precursors to cracks, corrosivity, corrosion, fatigue & impact damage
    - » *In-situ detection of cracks as they occur*
  - Key qualities: small footprint, distributed, non-invasive, remote response
  - Sensor and modeling solutions
- ❑ **Safer alternatives to RT**



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# Summary

- ❑ **Goal:** Find new technologies or new combinations of technologies which can solve Navy NDT&E needs.
  - Some non-new technologies may be new to the application
- ❑ **Key values:** Reliability, accuracy, ruggedness & speed
  - **Secondary factors:** Portability, ease of use, & real-time analysis
- ❑ **Challenges:** Environment / Biologics, thick materials, large structures
- ❑ **Focuses:**
  - **Tech interests:** SHM, portable, real-time, & at-sea solutions
  - **Defects:** Cracks, debonds, voids, water intrusion, degradation, & corrosion
  - **Materials:** Composites, polymers, & metals





# Questions?



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